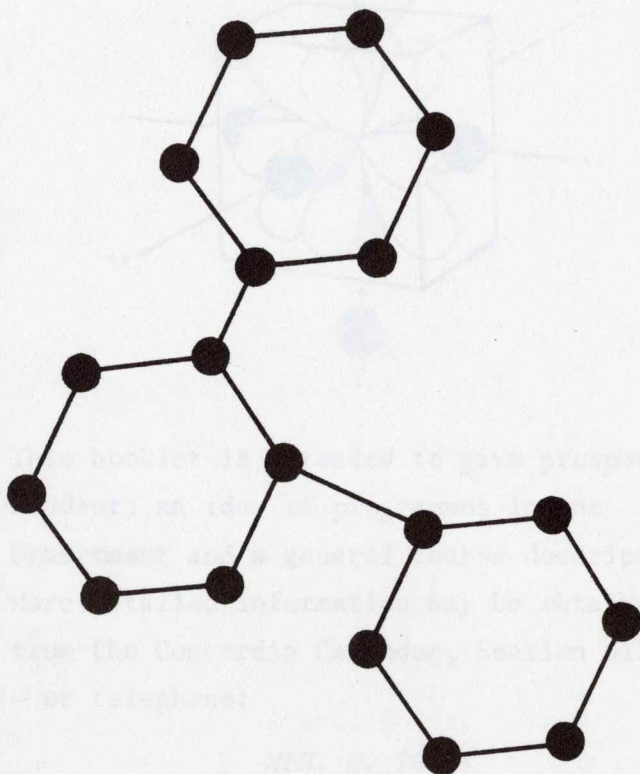


Science

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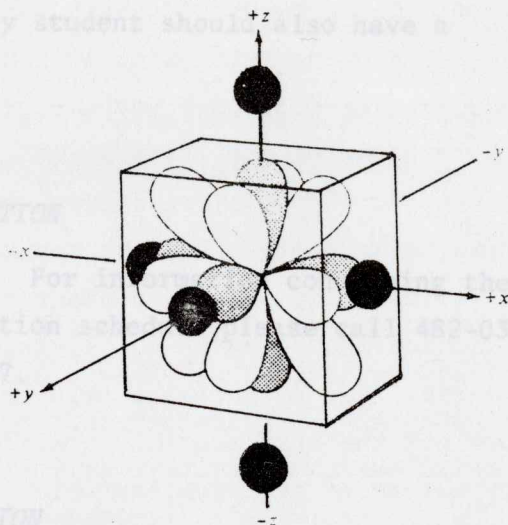
Concordia University Loyola Campus

Faculty of Arts and Science





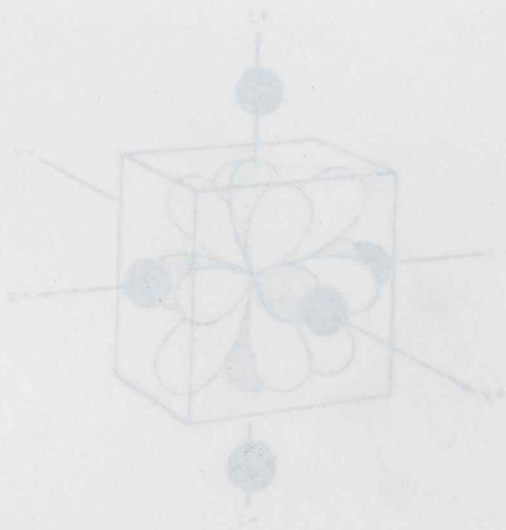
CONCORDIA UNIVERSITY
DEPARTMENT OF CHEMISTRY
LOYOLA FACULTY OF ARTS AND SCIENCE



This booklet is intended to give prospective students an idea of programmes in the Department and a general course description. More detailed information may be obtained from the Concordia Calendar, Section 51.6 - or telephone:

MRS. D. TOOBY
482-0320 - local 332

CONCORDIA UNIVERSITY
DEPARTMENT OF CHEMISTRY
CONCORDIA FACULTY OF ARTS AND SCIENCE



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482-0320 - Local 332

ADMISSION REQUIREMENTS

All potential students should have a D.E.C. which includes 2 chemistry, 2 mathematics and 2 physics. The bio-chemistry student should also have a biology.

REGISTRATION

For information concerning the registration schedule please call 482-0320, local 407.

INFORMATION

We invite you to phone us if you would like:

- i) more information
- ii) to discuss your plans
- iii) to visit our department.

You can arrange to talk with professors and/or students.

MRS. D. TOOBY

482-0320 - local 332

INTRODUCTION

The chemist plays an important role in today's society. The job includes the development of new materials, such as plastics for nose-cones on rockets which are capable of withstanding extremely high temperatures; new drugs to cure cancer and other health threats to man; new sources of clean energy, such as fusion and solar energy; and the monumental task of revitalizing our environment to control pollution and clean up our living quarters - earth. The potential chemist must therefore get the best possible training. The very nature of the problems which must be tackled and the needs of society demand that today's chemist must have a thorough training in the discipline, but it is also essential that this education include an understanding of the Humanities and Social Sciences. The Loyola Faculty of Arts and Science attempts to give the student an integrated education, while acquiring the essentials in a chosen discipline. We feel particularly qualified to meet these demands, since we are primarily an undergraduate faculty dedicated to teaching.

PROGRAMMES *

The student may choose either a Specialization or an Honours programme in chemistry, or a Specialization in bio-chemistry. All students may take the courses offered in any of these programmes. The main difference in the programmes is one of concentration - and in the case of the Honours programme, one of academic standing.

CHEMISTRY

The Specialization programme consists of 66 credits in chemistry, and 12 credits in other sciences. This gives the student 18 free credits to pursue other fields of interest.

The Honours programme is more intense, since 78 credits are specified in chemistry and 12 credits in other sciences. This represents a high concentration in chemistry, and the student is expected to maintain an Honours standing of no less than 65% in any chemistry course. There are still 18 credits that the student must choose outside of science.

* - See page 44.

BIOCHEMISTRY AND MEDICINAL CHEMISTRY

This programme is a recent development, created to meet the needs of the students and of the various industries in and around Montreal. The biochemistry programme is unique - it offers pharmacology and medicinal chemistry at the undergraduate level - a first in Québec. Students are prepared for a wider choice in careers. They are candidates not only for graduate studies in biochemistry, but also for a career in the pharmaceutical industry, nutrition and food industry, hospital and research laboratories, and a wide range of para-medical areas, such as microbiology and physiology.

The Concordia calendar - Section 51.6 - will give you the particulars of these programmes. An overview may be obtained from the tables on pages 5 and 6.

NOTE: In addition to the courses outlined in the tables, the Honours student is required to undertake a minor research project in a branch chemistry of interest to the student. (see page 35)

CHEMISTRY						
COURSES	SPECIALIZATION			HONOURS		
	YR. I	YR. II	YR. III	YR. I	YR. II	YR. III
Inorganic Chemistry	X		X	X		X
Physical Chemistry	X	X	X	X	X	X
Organic Chemistry	X	X		X	X	X
Analytical Chemistry	X	X		X	X	
Mathematics	X			X		
Electives	X	X	X	X	X	X
Science Elective		X	X		X	X

ALL OF THE ABOVE PROGRAMMES MEET THE REQUIREMENTS FOR MEMBERSHIP IN THE ORDER OF CHEMISTS OF QUEBEC.

BIOCHEMISTRY			
SPECIALIZATION			
COURSES	YR. I	YR. II	YR. III
Physical Chemistry	X	X	
Organic Chemistry	X	X	
Analytical Chemistry	X	X	
Biology	X	X	
Mathematics	X		
Electives	X	X	X
Science Elective			X
Biochemistry		X	X
Pharmacology			X
Medicinal Chemistry			X

ALL OF THE ABOVE PROGRAMMES MEET THE REQUIREMENTS FOR MEMBERSHIP IN THE
ORDER OF CHEMISTS OF QUEBEC.

FACILITIES

The Department has the necessary equipment and instrumentation to prepare our graduates for either industry or graduate school. These are housed in suitable laboratories that are supervised by both professors and skilled technicians.

SCHOLARSHIPS, AWARDS, MEDALS, PRIZES, ETC.

Scholarships and prizes are given in recognition of academic achievements. Our graduates have an admirable record in being awarded N.R.C. and Centennial Scholarships. The Chairman of the Department will advise you, on request, how to apply for these awards. In addition, it is possible to obtain financial assistance in the form of bursaries and loans.

COURSE DESCRIPTIONS

The programme is arbitrarily divided into six areas:

<i>ANALYTICAL</i>	<i>page 9</i>
<i>BIOCHEMISTRY</i>	<i>page 15</i>
<i>INORGANIC</i>	<i>page 20</i>
<i>ORGANIC</i>	<i>page 24</i>
<i>PHYSICAL</i>	<i>page 31</i>
<i>MISCELLANEOUS</i>	<i>page 36</i>

A brief description of each area precedes the list of course offerings. Note that these include full courses (two semesters - 6 credits) and half courses (one semester - 3 credits). Please consult the Concordia calendar, section 51.6, for more details of course content, prerequisites and sequence of offerings, or phone the Chemistry Department (482-0320, local 332).

ANALYTICAL CHEMISTRY

Analytical chemistry is that branch of chemistry used in the separation and analysis of chemical substances. It is concerned with both chemical composition and chemical structure. It includes both quantitative analysis (how much is present?), and qualitative analysis (what is present?). While analytical chemistry may often be thought of as a technique used for analysis of inorganic material, it nevertheless does include the analysis of organic and biochemical materials as well.

An analytical chemist has a knowledge of the methods and instruments used for analysis, as well as of the basic theory on which these tools depend. A sufficient understanding of the principles of analysis is necessary in order to apply and modify analytical methods to solve a particular problem. The chemist can evaluate and correctly interpret the results of a qualitative analysis. He/she may even be a research chemist who studies the theory of analytical processes or develops completely new methods of analysis.

The basic analytical chemistry programme consists of four closely integrated half courses, worth a total of 12 credits, spread over University I and II, (Chem. 342, 344, 442, 444) which, taken together, give the student a thorough knowledge of the great majority of existing methods of analysis. Each half course includes both lectures and laboratory practice - the sum total of which provides the student with a firm grasp of the theory and practice of analytical chemistry. Honours and Specialization chemistry students take all four of these half courses. Biochemistry students normally take the first three half courses only, although some elect to take the final half course (Chem. 444) as one of their optional courses in order to round out their knowledge of analytical chemistry.

In addition, the analytical programme includes an optional half course on the "Analysis of Pollutants" (Chem. 541) which all chemistry and biochemistry students are welcome to pursue either in University II or III.

*COURSES**INTRODUCTORY ANALYTICAL CHEMISTRY - 342**(3 cr.)**DR. G. J. TRUDEL*

This course is an introduction to chemical equilibrium as applied to neutralization, precipitation, complexation and oxidation-reduction methods used in both gravimetric and volumetric methods of analysis.

Although designed to be primarily an introduction to the theory of gravimetric and volumetric analysis, the course is given in sufficient depth to provide the student with a firm foundation in classical analytical chemistry upon which subsequent courses in analytical chemistry are built.

The laboratory provides experience in carrying out typical volumetric and gravimetric analysis. The student learns, not only to accurately manipulate the kind of apparatus used in wet analytical chemistry, but also to interpret experimental data in a scientific manner.

*INTRODUCTORY ANALYTICAL CHEMISTRY - 344**(3 cr.)**DR. R. H. ZIENIUS*

This course provides a thorough introduction to the theory of spectroscopic methods of analysis most commonly applied to organic and inorganic samples, i.e. emission spectroscopy, and nuclear magnetic resonance spectroscopy. The practical part of the course provides further experience in the application of gravimetric and volumetric analysis as well as an introduction to some very simple instrumental techniques.

*ADVANCED ANALYTICAL CHEMISTRY - 442**(3 cr.)**DR. R. H. ZIENIUS*

An in-depth introduction to both electrochemical methods of analysis and separation techniques is the basis of this course. Electrochemical techniques such as potentiometry, electrogravimetry, polarography, amperometry, coulometry and conductimetry are discussed. The principal separation techniques considered are the various forms of chromatography (column, paper, thin-layer, gas).

The laboratory provides experience in the handling of more sophisticated instruments than are used in Chem. 344. The experiments carried out are intended to illustrate theory matter covered in both Chem. 344 and Chem. 442.

ADVANCED ANALYTICAL CHEMISTRY - 444

(3 cr.)

PROF. M. E. BALDWIN

DR. R. H. ZIENIUS

This course involves a theoretical consideration of the more specialized techniques of analytical chemistry, such as fluorescence spectroscopy, Raman spectroscopy, mass spectrometry, radio-chemical methods, etc. The laboratory is devoted to the analysis of organic compounds using both classical and modern spectroscopic techniques.

NATURE AND ANALYSIS OF POLLUTANTS - 541

(3 cr.)

DR. R. H. ZIENIUS

This course is intended to prepare a student already familiar with the basics of analytical chemistry, including instrumental analysis, to carry out air and water pollution studies.

Following a survey of major industrial and municipal pollutants, a description is given of measuring systems, sampling procedures, and concentration and separation techniques. Topics such as continuous monitoring systems, automated analyses, and the like, are also discussed.

BIOCHEMISTRY

Biochemistry studies the structure and dynamics of living matter on the molecular level. The enormous variety and complexity of bio-molecules and their intricate and precise interaction is the basis of the variety and abundance of living organisms. Their capacity to extract and transform energy from the environment and their self-replication are unique. Biochemistry, a very young science, utilizes various approaches and branches of science and of chemistry to explain the chemical basis of life and the ways this can be regulated and modified: it is a very inter-disciplinary science. At the same time, it forms the point of departure to many other related fields, e.g. in the biomedical and food related areas. A biochemist therefore needs a solid foundation in analytical, organic and physical chemistry, as well as in biology, physiology and microbiology. In addition, our programme includes a course each in medicinal chemistry and pharmacology, studying the molecular, cellular and organismic aspects of drug action and drug design. This addition is almost unique on the undergraduate level in Canada, and opens up employment in the pharmaceutical industry to our graduates.

In the first year, and in part of the second year, the student acquires a knowledge of basic chemistry and biology. The student begins to specialize in the second year by taking the introductory bio-chemistry course (Chem. 490), as well as a full course in bio-organic chemistry (Chem. 427). These courses give a thorough knowledge of bio-molecules, as well as metabolic processes and bio-degradation and synthesis of these partly simple, partly complex molecules. Enzymology and photo-synthesis are included as part of these courses.

In the third year, advanced bio-chemistry (Chem. 590) includes a number of selected topics, like the function of biological membranes, neuro-biochemistry, immuno-proteins, enzyme kinetics and other topics. Medicinal chemistry (Chem. 592) deals with the structure-activity relations of drugs from a molecular aspect, while pharmacology (Chem. 594) studies the effect of drugs on living organisms.

It should be mentioned that Concordia University has a vigorous graduate research programme in biochemistry and medicinal chemistry in which professors from several departments participate.

*COURSES**BIO-ORGANIC CHEMISTRY - 427**(6 cr.)* *PROF. M. E. BALDWIN**(see section on organic chemistry - p. 30)**INTRODUCTORY BIOCHEMISTRY - 490**(6 cr.)* *DR. J. G. PARKES*

This course deals with bioenergetics, metabolic degradation of food and bio-molecules, and the biosynthesis of the building blocks of living matter. Much emphasis is placed on enzymology and regulation of biochemical processes. Photosynthesis of carbohydrates by plants, the basic energy-producing reaction, is discussed.

The laboratory (two terms) introduces basic techniques - and then the student goes on to study experimentally the activity of enzymes and some metabolic processes.

*ADVANCED BIOCHEMISTRY - 590**(6 cr.)**DR. T. NOGRADY**DR. J. G. PARKES*

This is an up-to-date study of some frontier areas of biochemistry. The structure and function of biological membranes and their role in the transport of biomolecules are discussed. The chemical basis of neural transmission and immunological phenomena are studied, often using recent research articles instead of a textbook.

The laboratory, in the second term, deals with the use of modern techniques, like radioactive labelling of biomolecules and the semi-independent study of biological transport, protein and nucleic acid biosynthesis.

*MEDICINAL CHEMISTRY - 592**(6 cr.)**DR. T. NOGRADY*

This novel course, offered for the first time in 1975-76, deals with the biochemical and physicochemical principles of drug action, topography and properties of drug receptors, a systematic study of selected groups of drugs and principles of drug design. It investigates drug activity on the molecular level, i.e. interactions with biomolecules, like proteins, nucleic acids, etc. There is no laboratory connected with this course, but 50% of the mark is based on a compulsory review paper.

PHARMACOLOGY - 594

(6 cr.)

Drug action is investigated at the cellular and organismic level from a physiological point-of-view. Drug distribution, metabolism, toxicology and a selection of drug groups are treated with emphasis on neuropharmacology. The course is designed in such a way that it complements Chem. 592. There is no laboratory at present, but one will be offered as facilities become available.

INORGANIC CHEMISTRY

It has been said that "Inorganic chemistry is any phase of chemistry of interest to an inorganic chemist." Much of the subject matter of concern to the inorganic chemist overlaps with the areas of concern to both the physical chemist, and the theoretical chemist. At one time inorganic chemistry consisted of the descriptive chemistry of all of the elements, other than carbon, but it has evolved into a study of some aspects of bonding theory, structural concepts, and the new explanations in rapidly developing areas - such as metal-metal bonding, carbonyls, and sandwich compounds.

A comprehensive programme would include atomic structure, the periodic table, bonding theories, elements of crystallography, chemical equilibria, electrode potentials, acid-base theory, chemistry of the groups, organo-metallic chemistry, magnetic properties, spectra, and many more topics.

Our programme consists of a core of three half courses (312, 314, 412). These courses provide a basic introduction to inorganic chemistry, and are the requirements of the Quebec Order of Chemists. Students may broaden their knowledge by taking further elective courses - such as intermediate inorganic (414), advanced inorganic (413), or organo-metallic chemistry (415). These courses will introduce the student to more advanced topics.

COURSES

INTRODUCTORY INORGANIC - 312/314

(6 cr.)

DR. R. H. PALLER

This course is designed to provide the chemist with the basic concepts used by inorganic chemists. It includes atomic theory, the periodicity of the properties of the elements, and bonding theories.

The student is introduced to some ideas in stereochemistry or geometry of molecules, and some comparative chemistry of the non-transition elements.

THE TRANSITION ELEMENTS - 412

(3 cr.)

DR. M. G. HOGBEN

Magnetic and electronic absorption spectral properties are analysed using the theories of d-orbital interactions within the ligand field. The different ligands are divided into two groups (a) π -ligands: carbonyls, nitrosyls, unsaturated organic (organometallics) and (b) σ -ligands: traditional coordination chemistry. Particular attention is paid to the bonding and physical properties of these compounds though the usual chemical properties and industrial applications are not neglected.

*MAIN GROUP ELEMENTS - 414**(3 cr.)**DR. M. G. HOGBEN*

The systematic survey of non-transition elements is continued from Chem. 314 including the Noble gas compounds and Interhalogens. This is followed by special topics such as Chains, rings and other polymers (silicates and carboranes); introduction to organo-metallics.

*ORGANOMETALLIC CHEMISTRY - 415**(3 cr.)**DR. M. G. HOGBEN*

Systematic survey of organometallic compounds in which stress is laid upon the preparation, chemical properties and application of organometallic compounds as novel catalysts in organic chemistry; industrial applications and in biological systems.

Chem. 414 and 415 are usually given in alternate years.

The third course (Chem. 427) is bio-organic chemistry and considers the organic chemistry and biological implications of a selection of natural products of biochemical interest. This course is also available as an elective to students in the chemistry programme.

In addition, two half courses (Chem. 327, 329) in organic chemistry are offered as a general introduction to organic chemistry, specifically for students in the Biophysical Education programme.

*COURSES**ORGANIC CHEMISTRY THEORY - PART I - 322**(6 cr.)**DR. M. DOUGHTY*

This course is the first half of a four term programme in organic chemistry. It establishes a thorough knowledge of bonding theory in organic molecules, stereochemistry, and the relationships between molecular structures and reactivity before commencing the discussion of organic reactions from a mechanistic point of view.

The laboratory work covers fundamental techniques of separation, isolation and purification of organic compounds, stereo-chemistry and practical examination of some of the principles involved in the study of simple reaction mechanisms.

*ORGANIC CHEMISTRY THEORY - PART II - 422**(6 cr.)**DR. O. TEE*

This course is the continuation of Chem. 322, and completes the discussion of the basic reaction mechanisms and synthetic methods of organic chemistry at a more advanced level.

The laboratory work involves the synthesis of a selection of organic compounds chosen to illustrate various types of reactions and synthetic techniques.

*ORGANIC CHEM. FOR BIOPHYS. ED.-PART I - 327**(3 cr.)**DR. M. DOUGHTY*

This course is a first offering of general organic chemistry specifically for Bio-Physical Education students. In no sense is it to be regarded as equivalent to Chem. 326 which is primarily for biologists. The stress is on the structure of organic molecules, particularly those of a physiological significance. Aliphatic and aromatic molecules are studied, along with such concepts as bonding theory and stereochemistry. There is a laboratory session to introduce fundamental techniques in organic chemistry.

*ORGANIC CHEM. FOR BIOPHYS. ED.-PART II- 329**(3 cr.)**DR. M. DOUGHTY*

A continuation of 327 with reference to the chemistry of functional groups. Amino-acids and protein structures are examined in detail. There is more theory in this second half, since no further laboratory work is demanded of Biophysical Education students.

*ADVANCED ORGANIC LABORATORY - 423**(3 cr.)**STAFF*

In this course each student works under the direction of a faculty member on an individual problem which may involve synthesis or structure determination. Emphasis is placed on the use of research literature, spectroscopic methods and advanced techniques.

*ORGANIC CHEMISTRY - PART I - 326**(3 cr.)**PROF. M. E. BALDWIN*

This course is the first part of a general introduction to organic chemistry with biological emphasis. The topics covered include bonding theory, concepts of molecular structure, stereo-chemistry, some simple reaction mechanisms, and the structure and reactions of aliphatic and aromatic hydrocarbons. Examples and practical applications of biological interest are stressed. The laboratory work introduces the students to the fundamental techniques of isolation and purification of organic compounds, and some simple syntheses.

*ORGANIC CHEMISTRY - PART II - 328**(3 cr.)**PROF. M. E. BALDWIN*

This is a continuation of Chem. 326, and the course examines the chemical reactions and behaviour of some of the main functional or reactive groups of organic molecules, including halides, alcohols and phenols, carbonyl compounds, carboxylic acids and their derivatives, amines and some nitrogen containing compounds. Practical applications to such groups as detergents, foods, drugs, pesticides and cell components are considered. The laboratory work gives practical examples of the behaviour and reactions of some typical functional groups, and some simple and multi-step syntheses.

*BIO-ORGANIC CHEMISTRY - 427**(6 cr.)**PROF. M. E. BALDWIN*

In this course, aspects of the molecular structure and reactions of the organic components of cells are studied, including carbohydrates, amino acids and proteins, lipids, nucleotides and nucleic acids. The chemistry and biological implications of a selection of natural products such as steroids, terpenes and alkaloids are also discussed.

PHYSICAL CHEMISTRY

Physical chemistry includes such a broad and diverse range of subject matter as to defy easy definition; indeed, many would dispense with the term altogether in favour of the more specific disciplines such as thermochemistry, molecular spectroscopy, quantum chemistry, reaction kinetics, statistical mechanics, and so on. Nevertheless, physical chemistry remains one of the major divisions of the chemistry curriculum where it plays a central and unifying role; the instrumental techniques and theory of all branches of chemistry are in large part outgrowths of physical chemistry.

As the name suggests, physical chemistry lies at the crossroads of the physical sciences, and increasingly, of the earth and life sciences as well. It deals experimentally and theoretically with the physical properties of matter in all states, and with the nature of chemical processes, such as thermodynamic feasibility, rates and mechanisms of reactions. It is the physics of chemistry and requires much advanced applied mathematics.

COURSES

INTRODUCTORY PHYSICAL - 336

(6 cr.)

DR. K. EKLER

An examination in some detail of the basic areas of physical chemistry with as much vigour as the students' preparation will permit. Such areas as the gas state; first, second and third laws of thermodynamics; thermochemistry; chemical kinetics; liquids; colligative properties of solutions; photochemistry and phase equilibria are considered. Lectures only.

PHYSICAL CHEMISTRY FOR BIOCHEMISTS - 338

(6 cr.)

DR. G. J. TRUDEL

The course is not intended to be a rigorous treatment of the subject of physical chemistry but an attempt to arouse the students' interest in acquiring an understanding of the basic concepts of physical chemistry as they apply to living systems. Such topics as heat, work, energy, entropy, free energy, properties of liquids, transport processes, properties of electrolyte solutions, chemical kinetics and photochemistry are considered.

*PHYSICAL CHEM. LABORATORY - 432**(6 cr.)**DR. D. McELCHERAN*

First term: preparation for the laboratory treatment of experimental data, the computer and elementary Fortran, numerical methods.

Second term: twelve experiments of wide range including properties of the gas and liquid states, phase equilibria, thermochemistry, electrochemistry, reaction kinetics, surface phenomena.

*CHEMICAL THERMODYNAMICS - 433**(3 cr.)**DR. K. EKLER*

This course represents the second time that the student encounters thermodynamics. The topics include isothermal and adiabatic expansion, heat engine, heat pump, entropy, Gibb's free energy, fugacities, equilibrium constant, Third Law of thermodynamics, electrolytes and non-electrolytes.

*STATISTICAL MECHANICS - 435**(3 cr.)**DR. D. McELCHERAN*

Classical and quantum molecular distributions, kinetic theory of gases and liquids, transport phenomena, statistical thermodynamics, reaction rate theory.

*ELECTROCHEMISTRY - 531**(3 cr.)*

DR. K. EKLER

Conductivity of solutions, equivalent conductance, transference numbers, electrostatics activities. Ionic strength, solvation, Debye-Huckel Theory, Poisson-Boltzmann Equation, electromotive force of cells, Nernst Equation, equilibrium constant, solubility-product. Cells with and without transference. Concentrated solutions. Electrode kinetics. Overvoltage.

*THEORETICAL MECHANICS - 532**(6 cr.)*

DR. D. McELCHERAN

Mathematical preliminaries including vector differential operator and integral theorems, matrix algebra, group theory, a brief survey of electromagnetic theory and special relativity; quantum mechanics, development of the Schrodinger wave equation and closed solutions, perturbation theory and the helium atom, variation method and the hydrogen molecule; valence bond, molecular orbital and ligand field theories of chemical bonding, the spectra and structure of atoms and molecules.

*SENIOR PROJECT**CHEM. 552 (6 cr.)**STAFF*

In Year III, the Honours student is required to undertake a small research project. These projects are directed by the faculty members in their particular field of interest and expertise. The student is free to choose both the project and the director. A written report is a mandatory part of this course. The aim of this project is to introduce the student to the methods of research and problem-solving on a practical scale, and to develop a discriminating analytical attitude. It also brings the student into contact with current literature and journals.

MISCELLANEOUS COURSES

A number of courses are offered by the Department which cannot be catalogued as belonging to any of the already listed branches of chemistry. In fact, these courses are rather interdisciplinary within chemistry. One course on "industrial chemistry" (452) is a required course for those students specializing in chemistry, and is an elective open to all chemistry, biochemistry and biology students. Two other half courses on "photographic chemistry" (315, 317) are given primarily as service courses for Communication Arts students. Two half courses on "polymer chemistry" (523, 525), a half course on "environmental chemistry" (411), and a half course on "radiation chemistry" (535), are offered as electives to chemistry students, and may be taken in either University II or III.

A selection of one or more courses from this area will help students to round out their undergraduate training in chemistry.

COURSES

INTRODUCTORY CHEMISTRY - 112

(6 cr.)

A pre-university course presented for the mature students' programme, or for the student who wishes to transfer into a science programme. The basic principles of chemistry are covered. The presentation of this course is suited to students who have had no previous knowledge of chemistry. The topics include molecular and atomic theories, balancing equations, valence, gas state, oxidation/reduction, equilibria, etc.

A laboratory is part of the curriculum for this course.

*CONCEPTS IN SCIENCE - 300**(6 cr.)*

An elective course for students outside the science discipline who perceive that a lack of science may alienate them from much of the world's activity and writing. Students will learn some of the fundamental principles and concepts within science with an eye toward developing a fuller appreciation of the different perceptions of the universe and of our own place within it. Topics will include: the molecular, atomic and nuclear structure of matter; the phenomena of light and optics; chemical elements and the periodic table; Newtonian and quantum mechanics; relativity; nuclear energy and radioactivity; the difference between living and non-living molecules, chemical basis of life, the cell; principles of astronomy; structure and evolution of stars and galaxies; cosmology and cosmogony; the origins of life.

*PHOTOGRAPHIC CHEMISTRY I - 315**(3 cr.)**PROFESSOR D. HUI*

It is very common for a photographer or a photographic laboratory technician to practice some conventional habits or follow instructions for years without knowing why. It is the intention of this course to reveal the mystery of darkroom photography, so that after taking this course, a person would be able to answer questions, make decisions, or satisfy his own curiosity about photography.

This is an introductory course on "photographic chemistry" for non-science students, with at least high school chemistry. It is to be taken concurrently with Physics 315 (3 cr.). Basic chemical principles for the study of the photographic process will be reviewed. Other topics such as photographic emulsion, developer constituents and their functions, water impurities affecting the process, relationship between temperature, agitation, development time and the degree of development will be discussed. Students are required to do experiments to demonstrate the theories they have learned.

*PHOTOGRAPHIC CHEMISTRY II - 317**(3 cr.)**PROFESSOR D. HUI*

This is the continuation of Chem. 315. It is also to be taken concurrently with Physics 317 (3 cr.). The course will cover the following topics in lecture and lab: Relationship between the concentration of developer and the degree of development; theory of fixation and thorough washing; fixer constituents and their functions; reversal processing; formation of latent image; conventional and modern theories of development. At the end of the course, students will have a chance to demonstrate their knowledge of photographic chemistry by working on a self-initiated or assigned project.

*ENVIRONMENTAL CHEMISTRY - 411**(3 cr.)**DR. D. McELCHERAN*

The chemistry of some of the compounds which threaten the quality of life for humans; the role which these chemicals play in the environment; the general reactions that they undergo; and some of the effects they have on life are examined. These include the effects known as air, water and soil pollution.

*ENVIRONMENTAL ANALYTICAL CHEMISTRY - 541**(3 cr.)**DR. R. H. ZIENIUS*

This course is described under Analytical Chemistry. (see page 13)

*INDUSTRIAL CHEMISTRY - 452**(6 cr.)**DR. R. H. ZIENIUS*

This course is intended to familiarize the student with the workings of the chemical industry, and to show how a knowledge of chemistry can be used in industry. Accordingly, a brief outline is presented of the history of the chemical industry, the development of chemical processes, unit operations and equipment followed by a discussion of those organic and inorganic industries of most importance to Canada. A minimum of eight half-day plant tours (more if the students wish) are an integral part of this course. They are intended to supplement the lecture material and to expose the student to real life chemistry. Included in the tours are visits to a pollution control plant, a pulp mill, an inorganic chemical and fertilizer plant, an oil refinery, a pharmaceutical manufacturer, a textile mill, a plastics plant, a food manufacturer and processor, and a water purification plant.

*POLYMER CHEMISTRY I - 523**(3 cr.)**DR. R. H. PALLEN*

Many of the materials common to everyday life are known as plastics. This course is a study of these compounds, and how they are formed, i.e. the mechanisms of the reactions which produce them. Some of the uses of the materials and some of their properties are discussed. Some general considerations of the reactions of these large molecules are introduced.

*POLYMER CHEMISTRY II - 525**(3 cr.)**DR. G. J. TRUDEL*

The science of macromolecules is divided between biological and non-biological materials. This course is concerned with the chemistry, physics and technology of non-biological polymers. These are primarily the synthetic materials used for plastics, fibers and elastomers, but a few naturally occurring polymers such as rubber, wool and cellulose are included.

*RADIATION CHEMISTRY - 535**(3 cr.)**DR. G. J. TRUDEL*

A brief and simple introduction to radiation chemistry. It is intended for students with a knowledge of chemistry who wish to make their first acquaintance with radiation chemistry.

This is an age when the boundaries between the main branches of chemistry are becoming more diffuse and studies are becoming interdisciplinary within chemistry and within science. A course in radiation chemistry clearly illustrates this trend. Radiation chemistry is far from being a narrow specialization. It draws upon and contributes to most other fields of chemistry and branches of science.

The study of the effects of radiation on chemical systems provides information about the mechanisms and rates of chemical reactions particularly those involving free radicals and ions, which are not readily investigated by conventional methods.

**TERMINOLOGY*

HONOURS - An Honours programme consists of 60 or more credits in a field of study with the student required to maintain a high academic record to enter and remain in the programme.

SPECIALIZATION - A Specialization is an approved sequence of courses of 60 or more credits. Although high academic performance is desirable, it is not a requirement to enter or remain in the programme.

MAJOR - You may major by taking a minimum of 36 credits in a discipline, such as history or chemistry, within a faculty.

MAJOR-MINOR - A major programme as described above may be combined with a minor programme in another discipline.

DOUBLE MINORS - Double minors programmes are made up of two approved sequences of 24 or more credits in two specific disciplines or fields.

FULL COURSE - 6 credits

HALF COURSE - 3 credits